POTTER **RAM**®

PRODUCT DATA
1-103

TLM–4505
A CARTRIDGE LOADED RANDOM ACCESS MEMORY

POTTER INSTRUMENT CO., INC.®

FOR THE FIRST TIME
A RANDOM ACCESS MEMORY
USING MAGNETIC TAPE

- Fastest Operation Available
- Automatic Cartridge Loading
- Unique Check-Read-After-Write Capability
- Non-Contact Recording
- Linear Head Positioning
- Extreme Dependability
- Simple Servicing

Figure 1. The Potter RAM
(a random access memory system)
Model TLM-4505, Shown with Model ACC-8606 Cartridge

Figure 2. Potter Tape Pack
Cartridge, Model ACC-8606

TAPE PACK FEATURES

- High Capacity — Over 50 Million Bits
- Low Price — Lowest Available
- Complete Data Security
- Interchangeable Cartridges
- Rugged Strength, Sealed Enclosure
- Lightweight — Readily Stacked
- Replaceable Low-Cost Storage Element

® Registered Trademark of Potter Instrument Company, Inc.

EFFECTIVE: SEPTEMBER 15, 1964

AUTOMATIC CARTRIDGE LOADING — Approximately 15 Seconds!

Operator Selects Tape Pack Cartridge.

Places Cartridge on Loading Carriage.

Presses "LOAD" Pushbutton. Fully Automatic Startup.

Figure 3. Cartridge loading is as simple for the operator as it is possible to make it. The cartridge is placed on the machine carriage; a latch snaps it secure. From this point everything is automatic. The operator simply presses the "LOAD" pushbutton and walks away, leaving the machine to load the cartridge, start up automatically, and signal the "ready" condition, all within a few seconds.

DRAMATIC STEP FORWARD IN PERFORMANCE CHARACTERISTICS!

Unlike any other machine in its class, the RAM can check-read data immediately after writing. This makes a dramatic difference in the performance characteristic. While other machines are occupied with the extra revolution of the recording medium, necessary to check-read, the RAM has already started the next access. Data throughput rates are enormously improved, and there is no need for the special data sequencing which attempts to minimize latency effects.

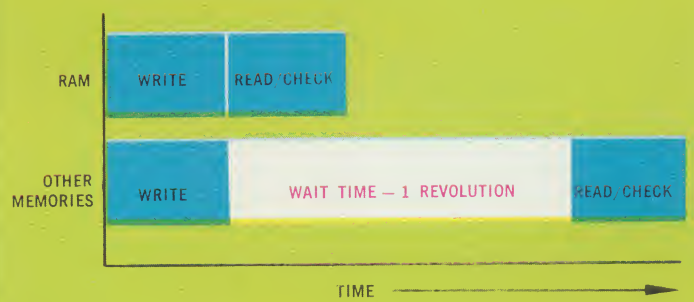

Figure 4. Comparison of RAM vs Competing Machines in Typical Operation

The remarkable characteristics of the RAM concept provide advanced performance plus simplified machine design, high reliability and lowest cost per bit stored. This is truly a breakthrough in design approach.

Comparisons between the RAM and other machines show typical operations being accomplished in half the usual time, with cartridge capacity doubled and cost per bit stored reduced to one quarter. In addition, vulnerable recording discs have been replaced by highly shock resistant magnetic tape sealed in rugged Tape Pack cartridges.

The Potter RAM is a cartridge loaded random access system for use with medium and low cost digital computer systems. Typical applications are: inventory control, computer programming, real-time data processing, and mathematical and scientific analyses . . . wherever rapid access to a volume of information is required, and where the information is too large to be economically accommodated by ferrite core memory systems.

Information is recorded serially in a multiplicity of tracks on loops of tape, and any information may be written or read at random by transmitting address information to the unit together with an appropriate command signal.

All channels have equal storage capacity and equal bit packing density. Thus, "zoned" arrangements of information, as used with disc memories to achieve reasonable storage efficiency, are not required.

UNIQUE TAPE PACK CARTRIDGE

The Model TLM-4505 accepts a Potter Model ACC-8606 Tape Pack Cartridge which has a storage capacity of 50.3 million bits of information. The tape loop assembly is totally enclosed within a dust-tight, rigid aluminum frame case. A door on the end of the cartridge case provides passage for the drive mechanism when in use. Plexiglass side and end panels permit immediate visual inspection of the storage elements at all times.

The complete cartridge assembly is highly resistant to rough handling. The rectangular form, convenience of handling, and light weight of the cartridge permits stacked storage in minimum space and very easy handling. The absence of close tolerance internal fittings avoid misalignment by careless handling, and the tape loops are inherently not subject to deformation and damage by shock and vibration.

Non-contact Potter high density recording is used in a "write broad-read-narrow" single track configuration. No permanent errors occur and the probability of transient errors are so low as to be a negligible factor.

Figure 5. Potter Tape Pack Cartridge, Model ACC-8606, Showing Magnetic Tape Loop Configuration

PRINCIPLES OF OPERATION

THE DRIVE SYSTEM

The loops of high quality digital magnetic recording tape in the cartridge each have an associated drive unit on the machine. Figure 6 shows the position of the tape loop which clears the drive assembly and the head as the cartridge is loaded, with the capstan stationary. When the tape loops are positioned, vacuum is applied to the buffer chamber above the capstan, deflecting the tape so that its backing surface makes a non-slipping contact with the surface of the capstan, which is now rotating. The tape loop is now in the driving condition as shown in Figure 7.

Of special importance is the fact that the tape flies over the write-read head, maintaining a precise and stable gap between the oxide recording surface and the head profile.

Figure 8 shows, diagrammatically, the fixed air bearings which control the tape loop, at top and bottom. These fixed elements conduct air under pressure to the bearing surfaces which forms a supporting film. Thus the tape loop is entirely supported on an air cushion while it is in motion.

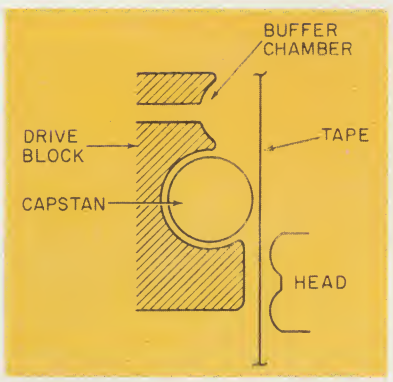

Figure 6. Position of Tape Loop As Cartridge Is Loaded

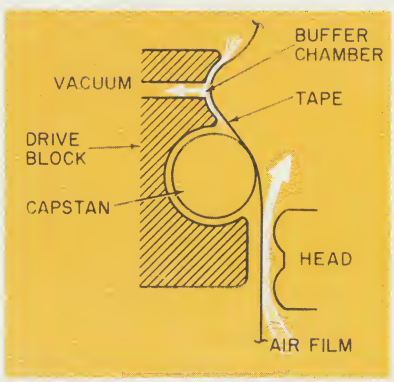

Figure 7. Tape Loop in Driving Condition

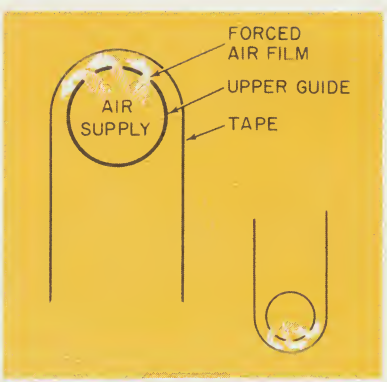

Figure 8. The Tape Loop is Entirely Supported on An Air Cushion While in Motion

PRINCIPLES OF OPERATION continued

MULTIPLE DRIVE BLOCKS

The individual drive blocks are arranged in two compact groups on the faceplate of the machine, with a common capstan serving each group. (Figure 9). A common vacuum supply is connected to all of the buffer chambers so that all loops are engaged in the driving position simultaneously, as part of the automatic load cycle. The twin capstans run in specially designed long-life bearings. Figure 10 shows the appearance of the drive assembly with one group of drive blocks removed to provide access to the head post. The vacuum and pressure porting can be seen and also the location of the capstan threading the remaining group of drive blocks. There are sixteen drive block sections in all, providing a 16 loop drive.

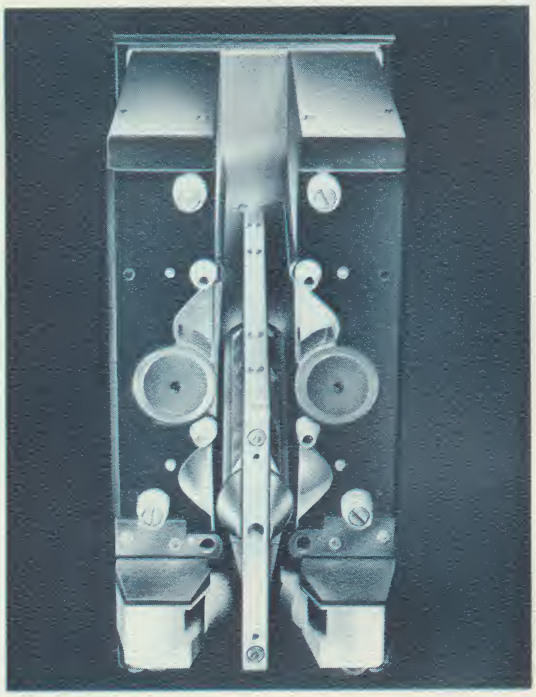

Figure 9. Multiple Drive Block Assembly

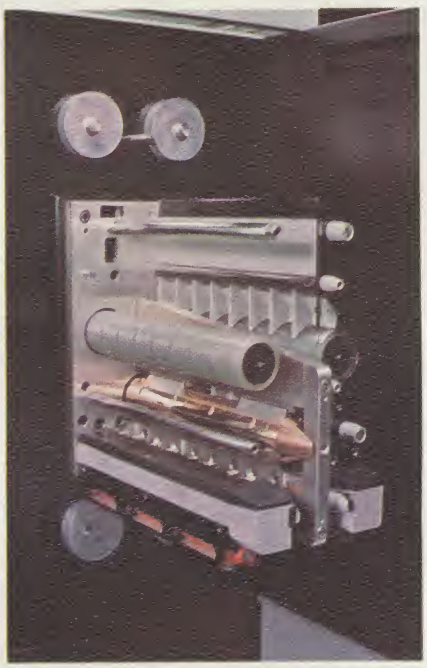

Figure 10. Multiple Drive Block Assembly with One Group of Drive Blocks Removed

HEAD POST ASSEMBLY

All of the write/read heads are mounted in a common head post located between the two groups of tape loops. The position of the head post can be seen in Figure 10. The general arrangement of the head post itself is as shown in Figure 11. The lower row of heads provides the writing function and the upper row the reading function. The heads are arranged in sections so that seven writing and seven reading heads are presented to each of the eight recording surfaces. A similar arrangement prevails on the other side of the head post to furnish reading and writing functions for the alternate group of eight loops.

The profile of the head post is contoured with a smooth surface finish, to define the desired stable flying attitude for the tape. The head post forms a rigid beam structure which permits the heads to be traversed over the recording surfaces under the control of the head post positioning mechanism.

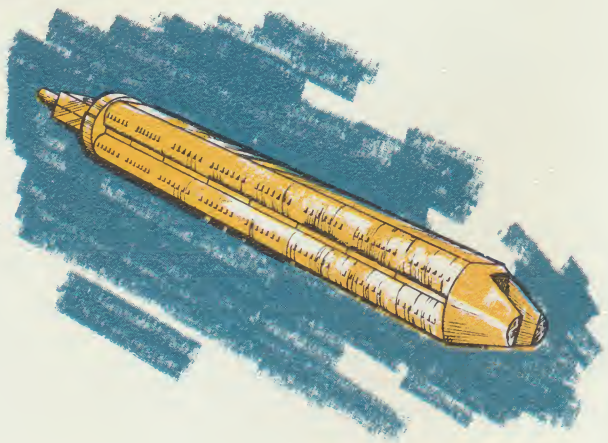

Figure 11. Write/Read Head Post

HEAD POSITIONING MECHANISM

Because the head positioning system demands only a linear movement of a single assembly over a very short distance, a simple mechanism is possible. This takes the form of a binary input positioning linkage sometimes referred to as a "whiffletree." A diagrammatic representation of the head positioning mechanism showing linkage relationships is given in Figure 12. Four equal amplitude input deflections acquire binary weightings, 1, 2, 8, and 4, from the linkage relationships, providing 16 precisely repeatable positions of the head post with very fast head shifting. The actual head positioning mechanism is shown in Figure 13.

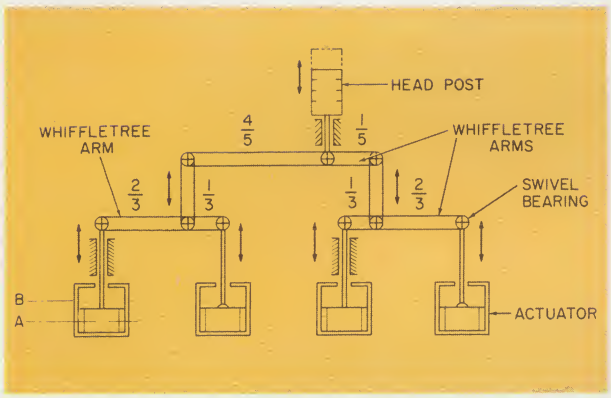

Figure 12. Diagrammatic Representation of Head Positioning Mechanism Showing Linkage Relationships

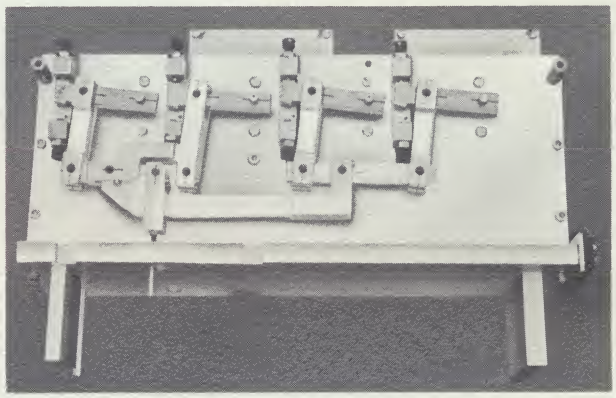

Figure 13. Head Positioning Mechanism

PERFORMANCE CHARACTERISTICS

The average access time to any stored record at random is made up of the average head positioning time plus an average latency time of one half revolution of the recording medium.

Check reading is performed immediately after writing. It is not necessary for the recording medium to make an extra revolution to check read, as required in other random access devices.

This is illustrated by the characteristic shown in Figure 14. At point A the first access to a record has been achieved in time T_1. Normally the time T_2 would elapse before check reading could be carried out at point B'. The RAM characteristic follows line AB, check reading at B still being achieved in time T_1 plus the very small increment of time which elapses due to gap spacing. The elimination of wait time for check reading results in higher processing rates.

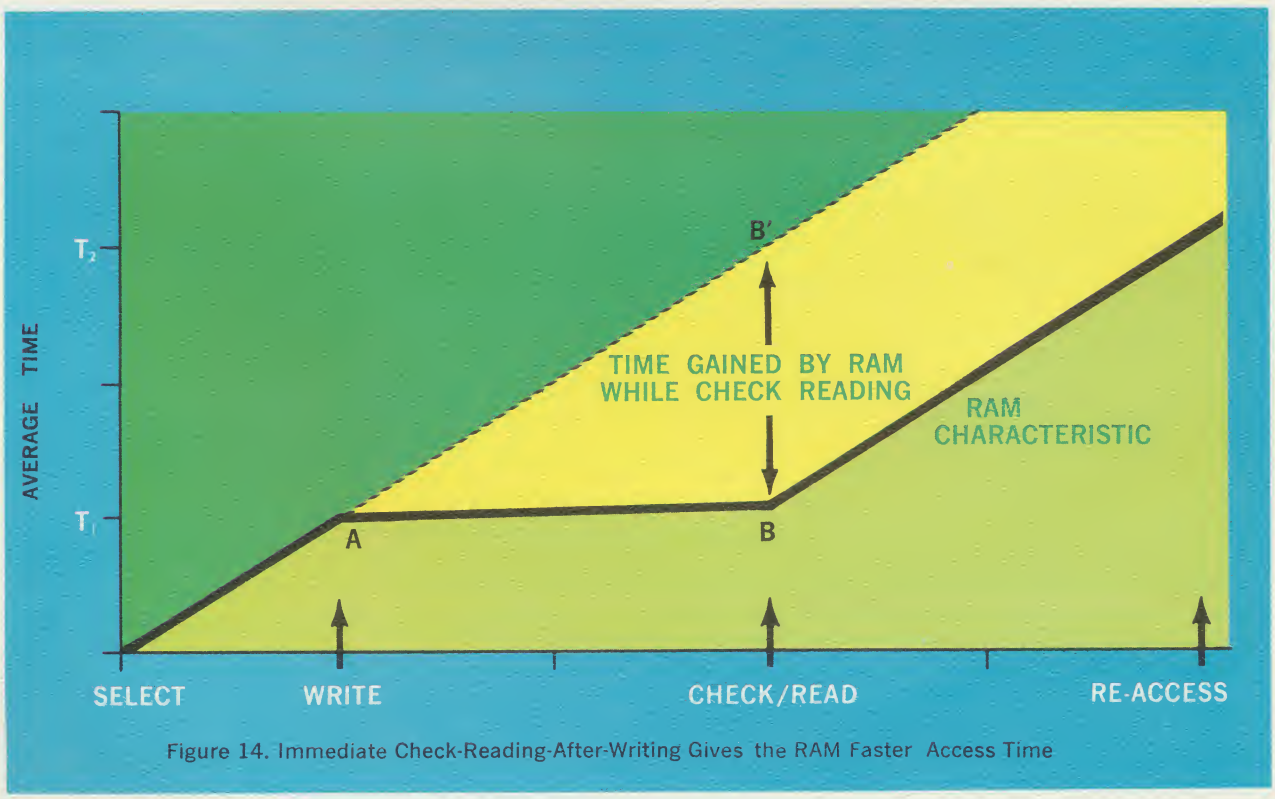

Figure 14. Immediate Check-Reading-After-Writing Gives the RAM Faster Access Time

PERFORMANCE CHARACTERISTICS
continued

DATA SECURITY

As the design approach of the RAM is reviewed feature by feature, it becomes obvious that a vital supplement to the higher performance/price ratio is the new order of data security that is realized. The use of a flexible recording medium eliminates machine damage and information loss resulting from head and disk crashes encountered in other random access memories. The sealed cartridges do not require the rigorous and elaborate machine room procedures which are essential to establish confidence in disk cartridge storage.

Spare tracks on the recording surfaces are unnecessary. Under normal conditions, the tape loops are practically indestructible and it is possible to recover data even in the extreme case of catastrophic damage to a cartridge housing.

SIMPLE MAINTENANCE

The maintenance required to insure reliability is reduced to a minimum and made exceptionally convenient and quick. After sliding back the transparent machine cover, drive blocks can be removed from their mountings after unfastening only two captive screws. This exposes the head post completely in a few seconds. The conveniently laid out components are all easily accessible in the frame assembly of the unit, which has removable cover panels.

EQUIPMENT

The complete Model TLM-4505 RAM System comprises:

Free standing cabinet of welded box frame construction with removable cover panels containing:
Faceplate and multiple drive block assembly with group drive actuators
Twin capstans and motor drive
Read/write head assembly with separate check read after write head
Head positioning mechanism
Cartridge holder and auto-load mechanism
Drive selection circuits
Head selection circuits
Load sequence control circuits and interlocks
Control pushbuttons: Power on/off, load and unload signal lamps with unit "ready" indicator
Vacuum generator and tape loop bearing air supply system
Power supplies, interconnecting wiring, cables, terminals, etc.

The equipment is furnished complete and ready for interconnection and operation with a suitable control source.

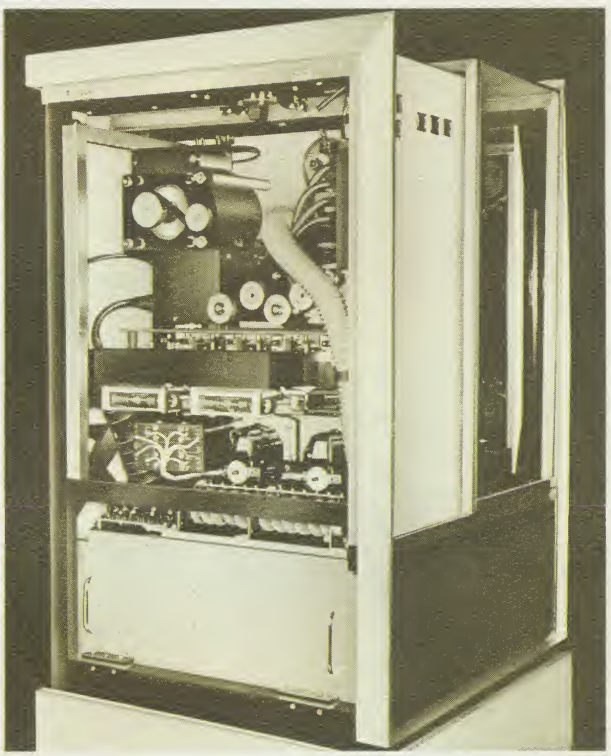

Figure 15. RAM with End Panel Removed

TAPE PACK CARTRIDGE

Tape Pack cartridges may be supplied on special order to cover a range of storage capabilities. The Model TLM-4505 RAM accepts a Potter Model ACC-8606 Tape Pack Cartridge which contains 16 tape loops, 30 inches in length and 2 inches in width. Storage capacity of the ACC-8606 cartridge is in excess of 50 million bits. All channels have equal storage capacity and equal bit packing density.

Complete specification for the TLM-4505 RAM and ACC-8606 Tape Pack are given on the following page. For further information, write, wire or call: General Sales Manager, Potter Instrument Company, Inc., 151 Sunnyside Boulevard, Plainview, New York (11803). Telephone: 516 OVerbrook 1-3200. TWX: 516-433-9320. Cable: PICO.

SPECIFICATIONS

MEMORY CONFIGURATION	Interchangeable cartridge type
METHOD OF RECORDING	Non-contact magnetic tape loops with Potter high-density recording in a "write broad-read narrow" single track configuration
STORAGE CAPACITY	50.3 million bits
INFORMATION PER TRACK	28,000 bits
INFORMATION PER CYLINDER	196,000 bits
DATA TRANSFER RATE (BITS)	600 kc/s
INFORMATION PACKING DENSITY	1,000 bits/inch, recorded serially
HEAD POSITIONING TIME	45 milliseconds, minimum 80 milliseconds, maximum
AVERAGE HEAD POSITIONING TIME	62.5 milliseconds
AVERAGE LATENCY TIME	25.0 milliseconds
AVERAGE ACCESS TIME	87.5 milliseconds
CHECK READ LATENCY TIME	1.7 milliseconds
AVERAGE CHECK READ/AFTER/WRITE CYCLE TIME	89.2 milliseconds (based on average access time)
TIME TO SCAN TRACK	50.0 milliseconds
CARTRIDGE CHANGE TIME	17 seconds, approximately
NUMBER OF TAPE LOOPS PER CARTRIDGE	16
NUMBER OF TRACKS PER TAPE LOOP	112
LENGTH OF TAPE LOOP	30 inches
TAPE WIDTH	2 inches
RECORDING LENGTH	28 inches
TAPE SPEED	600 ips
NUMBER OF HEADS PER RECORDING SURFACE	7
NUMBER OF HEAD POSITIONS	16
CYLINDER CAPACITY	Content of 7 tracks
READ/WRITE HEAD SEPARATION	1 inch, nominal
CARTRIDGE LIFE EXPECTANCY	5 years, typical

MODES OF OPERATION & CONTROL SIGNALS

Signals TO Unit

TRACK LOCATE (16 LOOP SYSTEM)	parallel input comprising 11 binary bits
WRITE ENABLE	Control Signal (level)
DATA INPUT	Serially at selected frequency

Signals FROM Unit

EQUIPMENT READY	DC level = 6 volts in ready condition
DATA INPUT	Serially at selected frequency

POWER	110/120V or 220/240V, 50/60 cps
DIMENSIONS CARTRIDGE, MODEL ACC-8606, 16 LOOPS, 50.3 MILLION BITS	approximately 13" W x 22" H x 8" D
CARTRIDGE STACKING FACTOR	96-98%
MACHINE (OVERALL DIMENSIONS)	approximately 48" W x 51" H x 23" D

About POTTER®

POTTER WORLDWIDE FIELD SERVICE AND LOGISTICS PROGRAM — Repair centers in strategic locations within the continental United States and abroad have been established to support the entire Potter product line.

Staffed by highly-trained field representatives, these repair centers are equipped to effect on-site installation of equipments and to perform quality repair, maintenance and overhaul.

Supplementing this capability, if a customer prefers to provide his own equipment support, Potter has established standard instruction courses to train customer personnel, either at Potter or in the field.

A Spare Parts Department, backed up by an extremely large inventory and streamlined order processing, is available for customer convenience and economy. This inventory permits the customer to realize virtual elimination of downtime as well as savings on spare parts dollars by offering expeditious delivery for replaceable parts. Delivery is available in 24 hours to meet customer emergency requirements—within 72 hours for standard parts under normal conditions. Potter also offers provisioning and logistics capabilities to meet all existing military specifications.

The Potter field service and logistics program is one of the finest in the EDP equipment industry. With reliable, quality-engineered equipment, supported by comprehensive field service, Potter guarantees satisfaction.

POTTER PLANTS — Tape transport production is carried on in this modern 62,000 sq. ft. plant on Sunnyside Boulevard, Plainview, New York. Building also houses corporate offices, sales, engineering and research groups.

East Bethpage Road plant (below), completed in 1963, produces high-speed printers. A third plant in Luquillo, Puerto Rico, manufactures magnetic and photoelectric recording and playback heads. Total manufacturing space in all Potter plants exceeds 110,000 sq. ft.

Present Potter employment is in excess of 650 people.

SALES OFFICES

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TO: General Sales Manager
Potter Instrument Company, Inc.

Check One

☐ I have current need for a low-cost, high capacity, fast access random access memory.
☐ I expect to have a future need for a low-cost random access memory.

* * *

The random access memory system would be used with a _____ (manufacturer) _____ (model) computer.

Application_____

_____

NAME_____ TITLE_____

COMPANY_____ TELEPHONE NO._____

ADDRESS_____ CITY_____ STATE_____

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